FOREWORD

More than a decade has passed since pulsars were discovered at Cambridge by J. Bell and A. Hewish. The past 13 years have seen extensive and at first rather hectic research, and a considerable amount of observational and theoretical knowledge has been accumulated.

Looking back over one decade of pulsar research, it seems worthwhile to ask what the real impact of the detection was and if our view of the universe has changed as a result of this discovery. The excitement of the first months and years has ebbed down considerably, with the result that pulsar research has become the task of a few scientists, working in small groups, scattered over many countries. As more and more knowledge was acquired, pulsars changed eventually from the bizarre pulsing objects — as they were considered in the beginning — to more normal stars of astrophysical interest.

Still, pulsars are the manifestation of matter in its most extreme form — neutron star matter — for which an equivalent can be found on earth only in the very nucleus of an atom. Neutron stars were predicted quite early in the history of modern astrophysics, and although many of their features were already known from theoretical studies, astrophysicists were not sure if we had the slightest chance to actually "see" these objects. It therefore took some time after the historical detection paper of Hewish and coworkers before astronomers became convinced that pulsars were neutron stars.

Based on the tremendous collection of observational and theoretical work presently available, the existence of neutron stars and neutron star matter is no longer a question of discussion; the idea — although in the beginning doubted quite seriously — has become so generally accepted that even the next step: the collapse of a star to a black hole, is now a subject of normal astrophysical investigation. Although the existence of black holes has as yet to be proved — in spite of a number of strong candidates — they are nowadays considered as the most probable physical explanation for a wide range of astrophysical phenomena, extending from galactic X-ray sources to the energy sources in the nuclei of powerful extragalactic objects.

The acceptance of the physical reality of neutron stars occurred at just the right time to facilitate the understanding of a variety of interesting observations present in another, rapidly developing branch of astrophysics: X-ray astronomy. Many galactic X-ray sources — particularly X-ray pulsars — can be understood in terms of binary systems

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involving neutron stars or other compact objects. The relation between neutron stars in X-ray systems and radio pulsars found special interest at this conference.

The general acceptance of the existence of neutron stars is certainly not the only outcome of 13 years of pulsar research, although possibly the most important. We might mention additionally the exciting first demonstration of the existence of gravitational radiation, which became possible by careful pulse timing measurements of the binary pulsar PSR 1913+16. Here as well, the phenomenon had been predicted years ago; it is in fact one of the interesting conclusions to be drawn from Einstein's theory of General Relativity. Considerable effort has failed to detect gravitational radiation directly and the PSR 1913+16 binary system remains the only quantitative example for its study.

On the other hand, there are many unresolved questions concerning pulsars, and these were given more attention at this conference than the resolved problems. In this connection we might mention the problem of magnetospheric constitution, where quite a lot of work must still be done; or of the radio emission mechanism, which is a coherent amplification mechanism and as such of high astrophysical interest. We might mention another open question about pulsars: their relationship to supernova events and supernova remnants. After the detection of PSR 0531+21 in the Crab nebula and PSR 0833-45 in the Vela supernova remnant, the causal relationship between supernova remnants and pulsars seemed well established. The failure to associate definitely any other pulsar with another supernova remnant now casts some doubt on this relationship. This doubt finds further support by the discrepancy in estimates of the birthrates of pulsars (deduced from pulsar surveys) and supernova remnants. Clearly the neutron stars in binary systems, especially X-ray binaries, must also find their place in a general picture of neutron star evolution. Here, too, new ideas have been presented at this conference and it will be interesting to see how this problem will be solved in the future.

All of the foregoing discussion indicated that it was time to have an IAU symposium on pulsars. After 13 years of data gathering, interpretation and theory a review of what has already been learned and which unresolved questions deserved further attention was necessary. This was the view of the Scientific Organizing Committee: R. Blandford, E.P.J. van den Heuvel, N. Kardashev, A.G. Lyne, L. Mestel, V. Radhakrishnan, M. Ruderman, J.H. Taylor, R. Wielebinski and its chairman R.N. Manchester, who had the responsibility for the scientific organization. It is a pleasure to thank the committee, and especially R.N. Manchester for the excellent, extended effort that went into the symposium.

The meeting could not have taken place without the financial support of the Deutsche Forschungsgemeinschaft, the Max-Planck-Gesellschaft, the I.A.U. and U.R.S.I. Their support is very much appreciated.

The local organisation was in the hands of N. Bartel, G. Breuer (conference secretary), W. Kundt, W. Sieber and R. Wielebinski (chairman). The venue of the conference were the Astronomische Institute der Universität Bonn and the adjoining Max-Planck-Institut für Radioastronomie. The smooth running of the conference was guaranteed by the personal efforts of Gabriele Breuer, Rosel Bock, Ursula Geisler and Hedwig Kalisch.

The conference proceedings were made in the standard IAU camera-ready form. This required the retyping of numerous contributions which were either too long or not up to the standard. The editors wish to state their particular appreciation to G. Breuer who made this venture possible with her tremendous effort and skill. The responsibility for errors which may have crept in in this process of retyping rests entirely with the editors.

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Bonn, December 1980 Richard Wielebinski

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